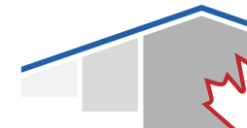




# Solar Row

Attached Housing Division

April 23<sup>rd</sup>, 2022



# Project Team



**Ben Brown**  
Hons. BSc., CPHD



**Mohammad Kassem**  
BEng. (Mech.), PMP,  
LEED GA



**Robin Macpherson**  
MA



**Yash P. Vyas**  
Technical Advisor  
BASc, MASc, CPHC



**Stanley Francispillai**  
BEng. (Civil), P.Eng.



**Zarifeh Zare-Moayed**  
Hons. BSc.



**Sacha Klein**  
Hons. BSc., REA



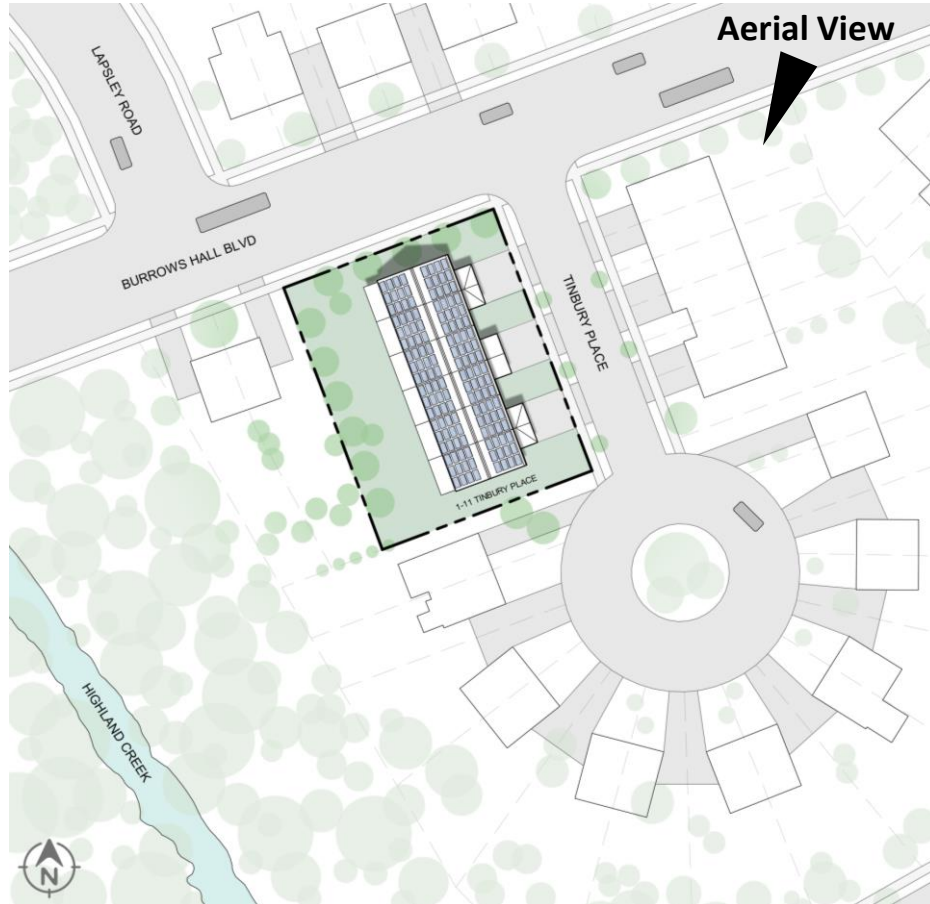
**Kevin Stelzer**  
Sustainability Advisor  
BES, BArch, OAA, MRAIC,  
LEEP AP BD+C, BSSO, CPHD

# A Trip Down Memory Lane... to the 1970s

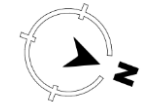
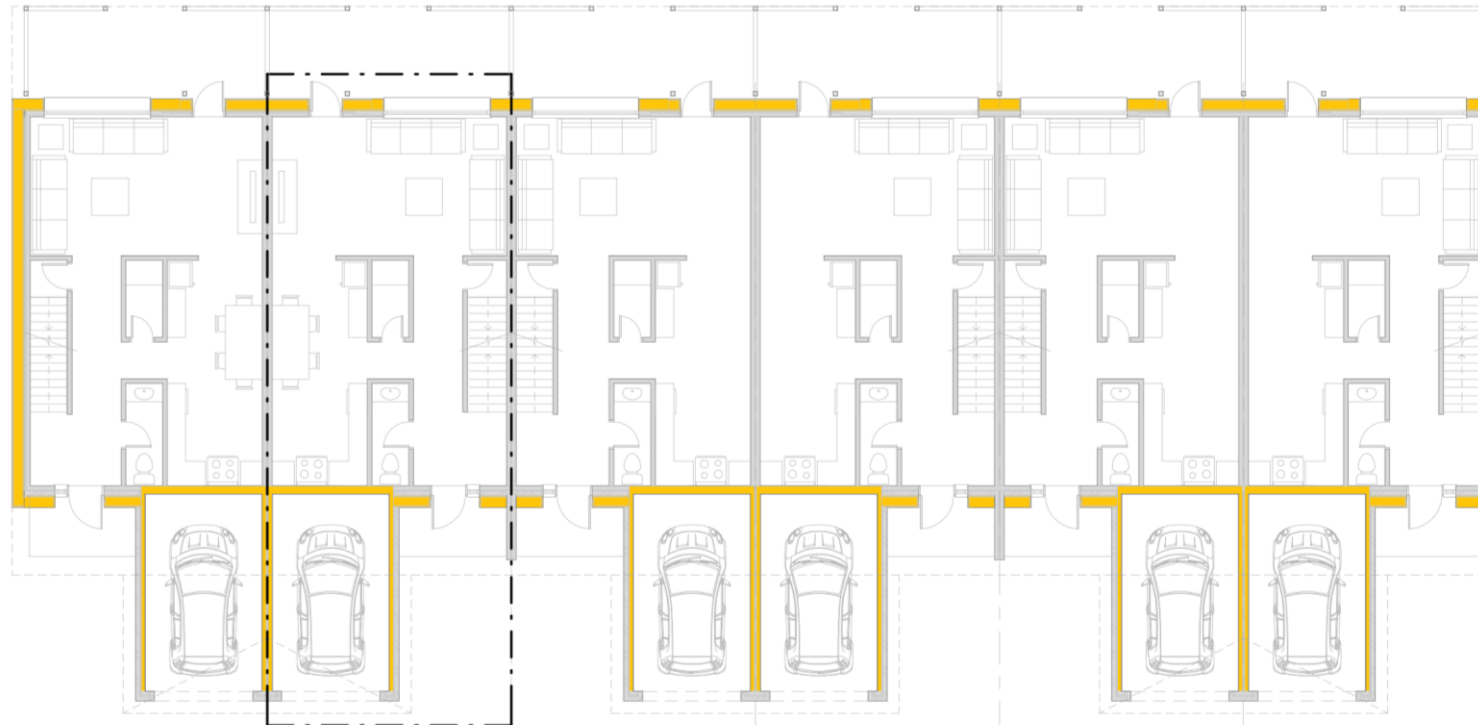




# Tinbury Place, Toronto



# Overall Floor Plan



**Existing**



**Proposed**



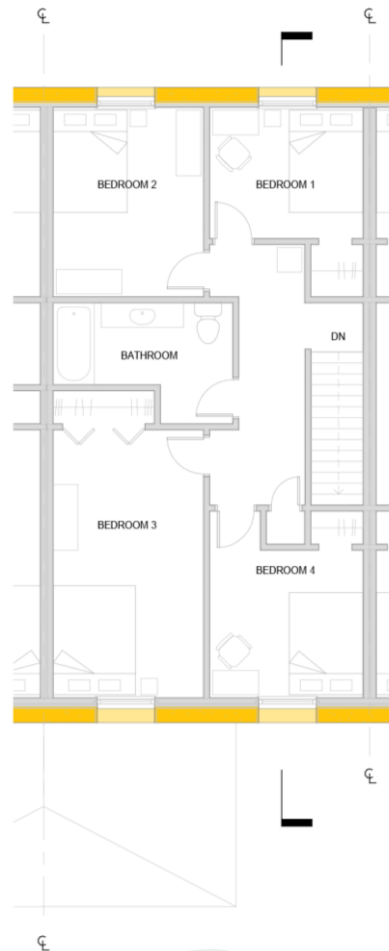
**Building Area**

4,812 ft<sup>2</sup>

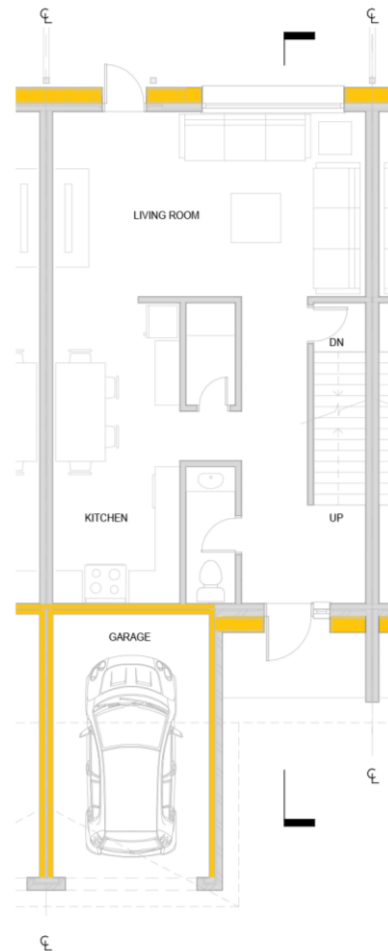
**Gross Floor Area**

11,670 ft<sup>2</sup>

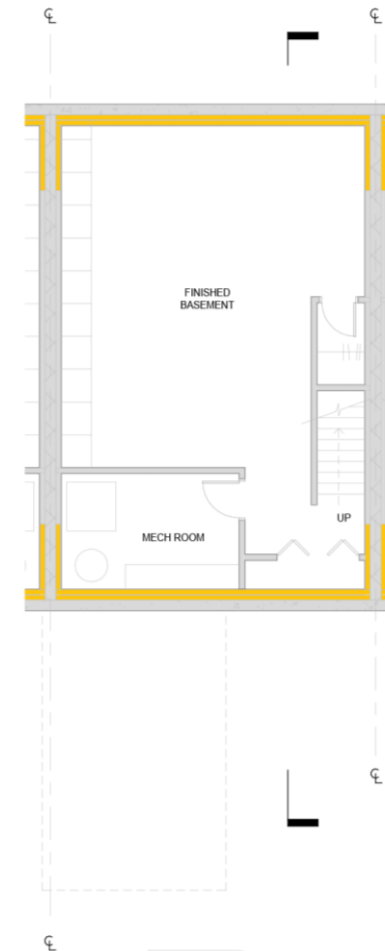
# Unit Floor Plans



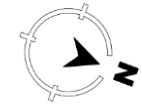
2



1



B



Existing

Proposed

Unit Gross Area

1,945 ft<sup>2</sup>

Unit Density

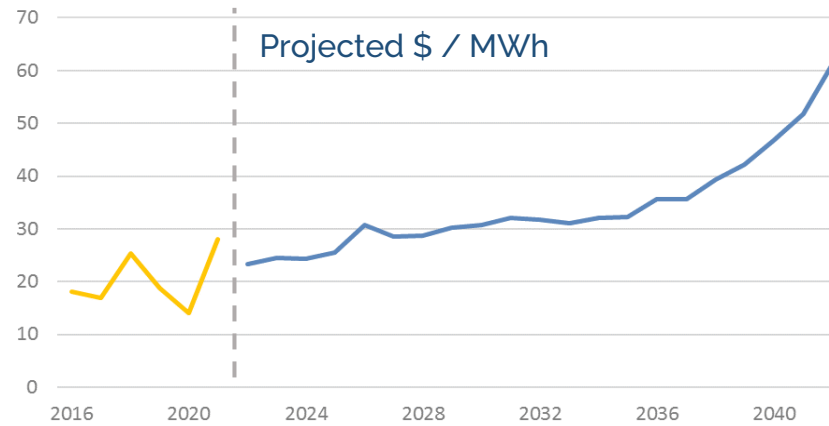
4 people  
(486 ft<sup>2</sup>/person)



# Design Drivers

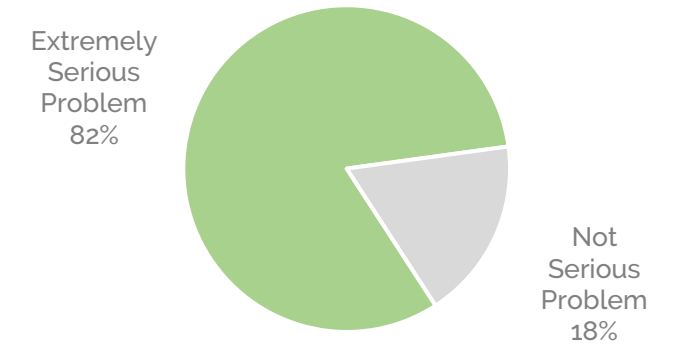


Housing

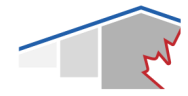


Energy

Canadian sentiment on Climate Change



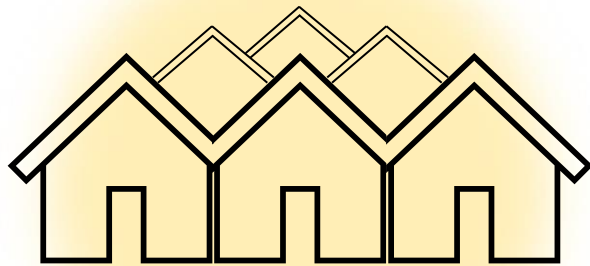
Climate Change



# Design Goals

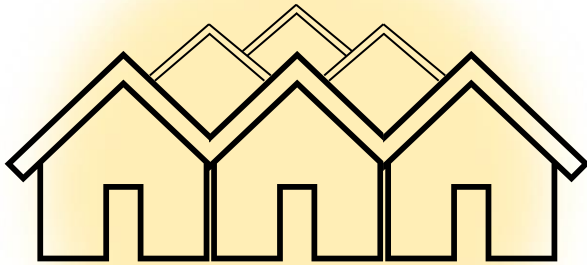


# Design Goals

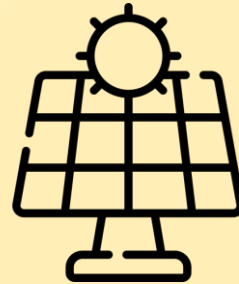


Scalable  
Design

# Design Goals

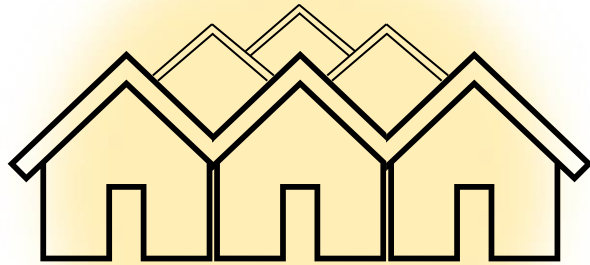


Scalable  
Design

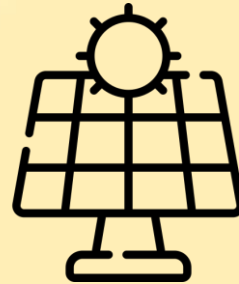


Net-Zero  
Energy  
Performance

# Design Goals



Scalable  
Design



Net-Zero  
Energy  
Performance

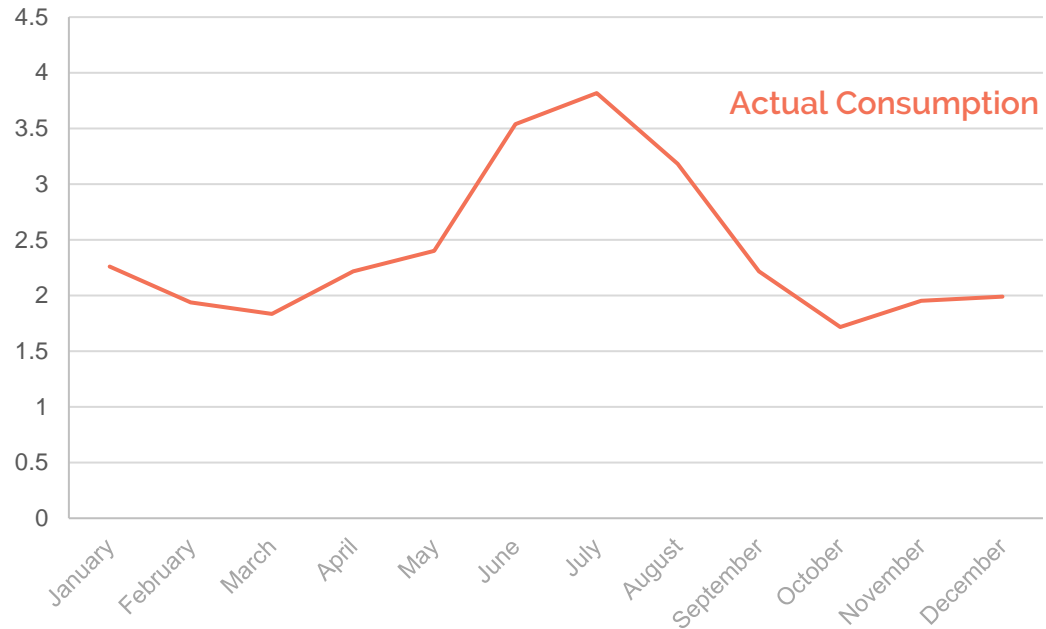


Occupant  
Wellbeing

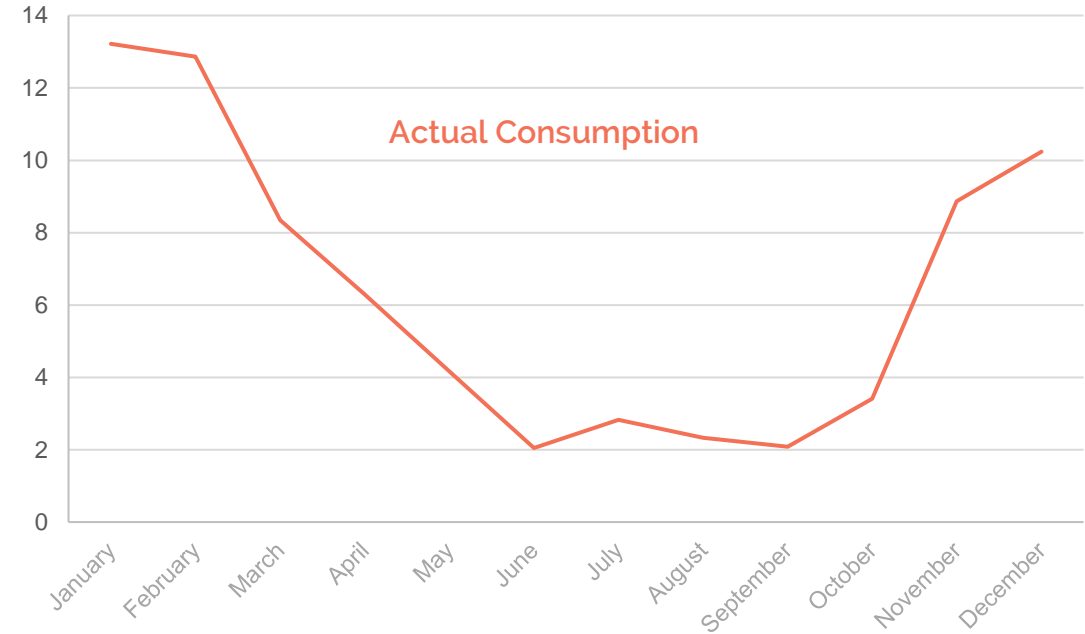


# Energy Model

Electricity Consumption (MBtu / Month)



Natural Gas Consumption (MBtu / Month)

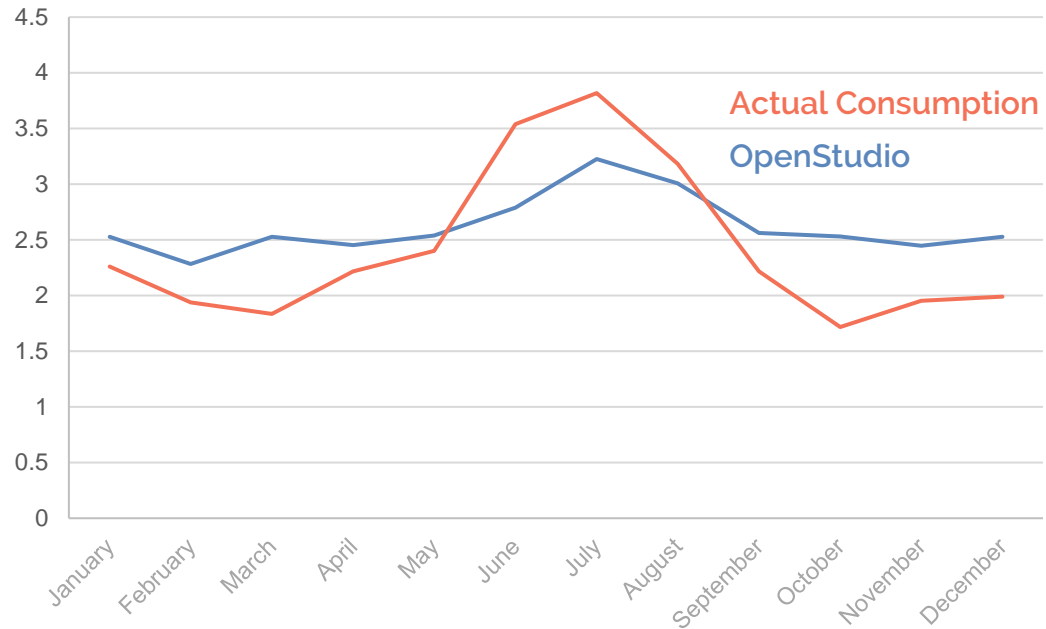


Verified energy model to within 8% of actual use

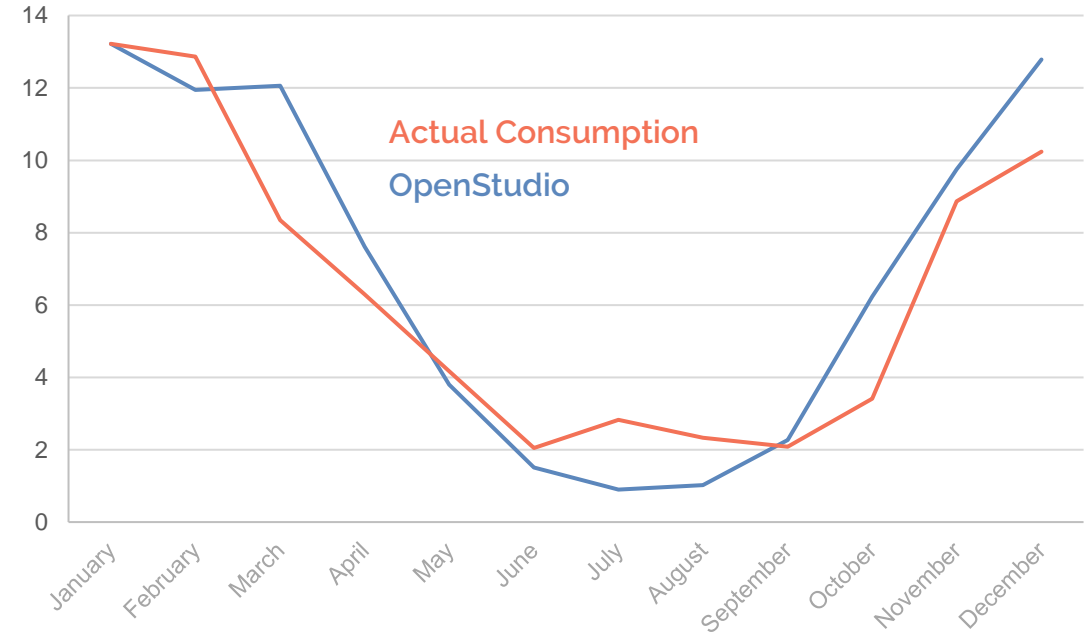


# Energy Model

Electricity Consumption (MBtu / Month)



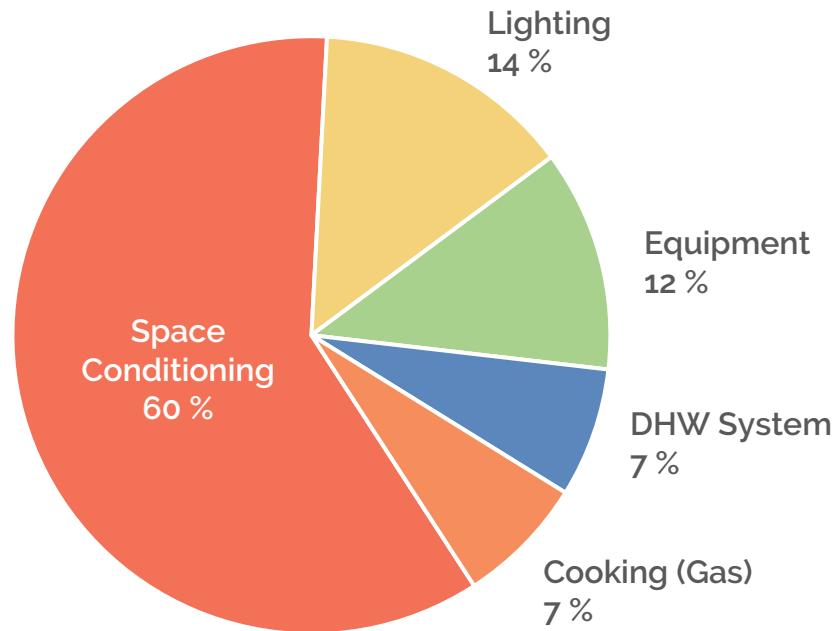
Natural Gas Consumption (MBtu / Month)



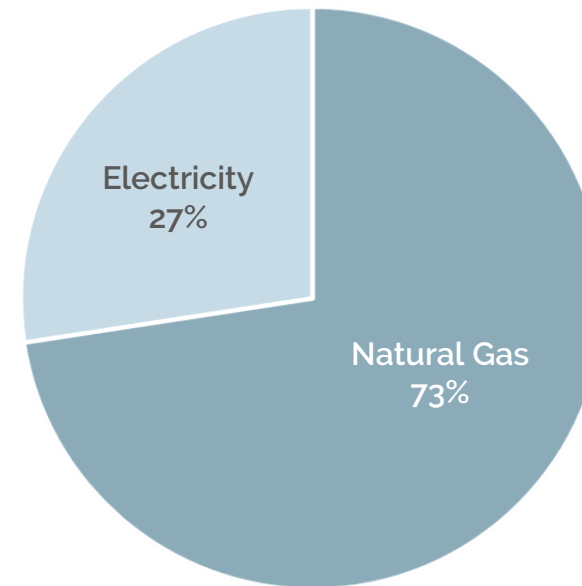
Verified energy model to within 8% of actual use

# Existing Energy Data

Energy Use by Category



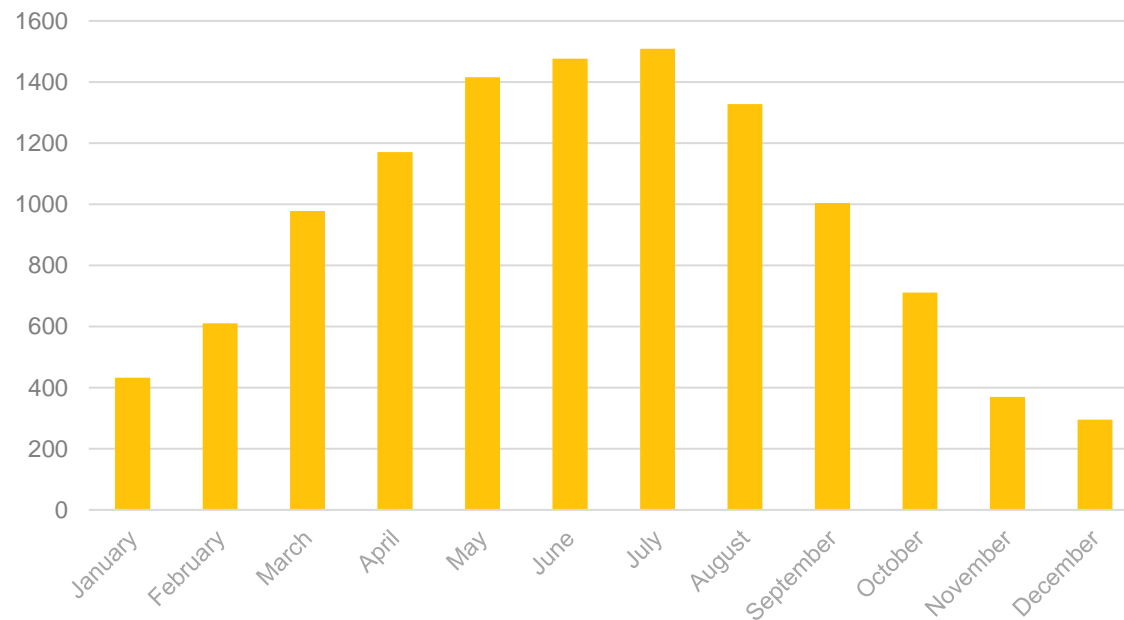
Energy Use by Fuel Type





# Energy Budget

Monthly Solar Production (kWh) / Unit



 HelioScope



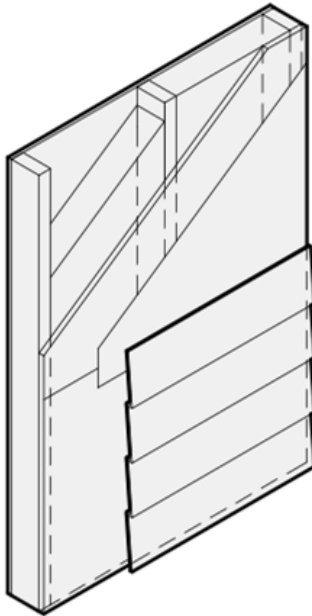
**10.3 kW**

Module Size / Unit

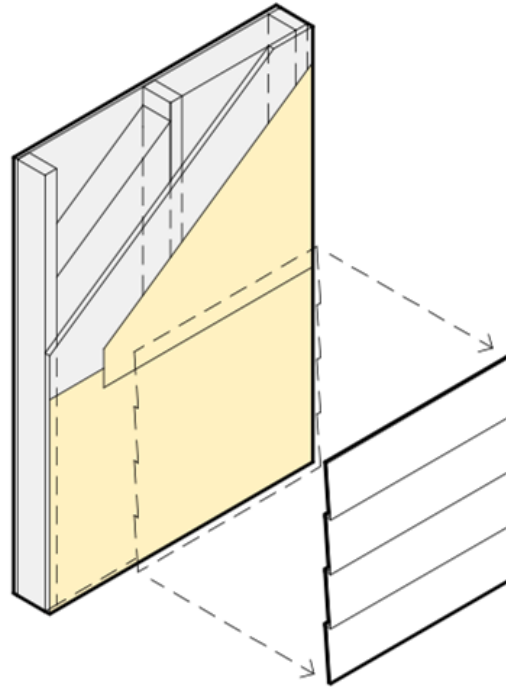
**11,530 kWh**

Annual Production / Unit

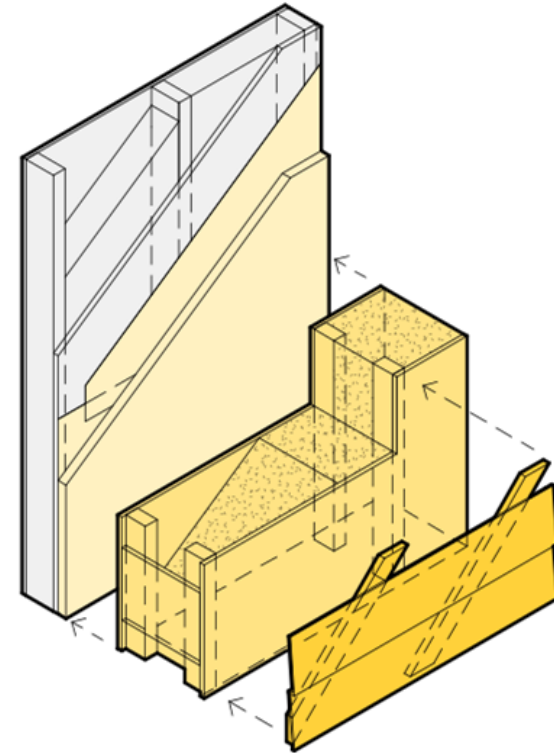
## EXISTING



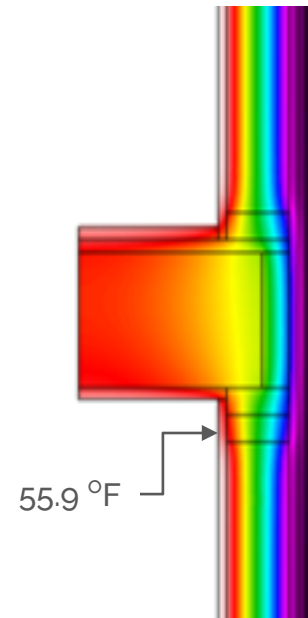
## REMOVE & REPAIR



## IMPROVE

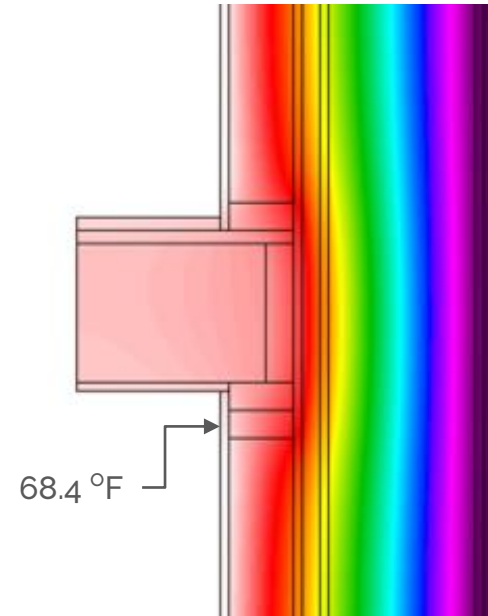


## EXISTING



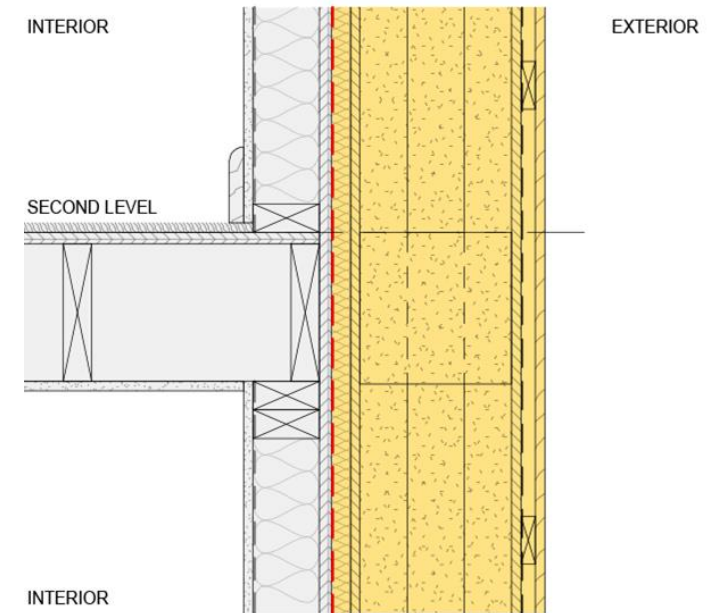
ψ-Value  
**0.116 BTU/h·ft·°F**

## IMPROVED



ψ-Value  
**0.008 BTU/h·ft·°F**

## REALIZED







Existing

Air Barrier

Proposed



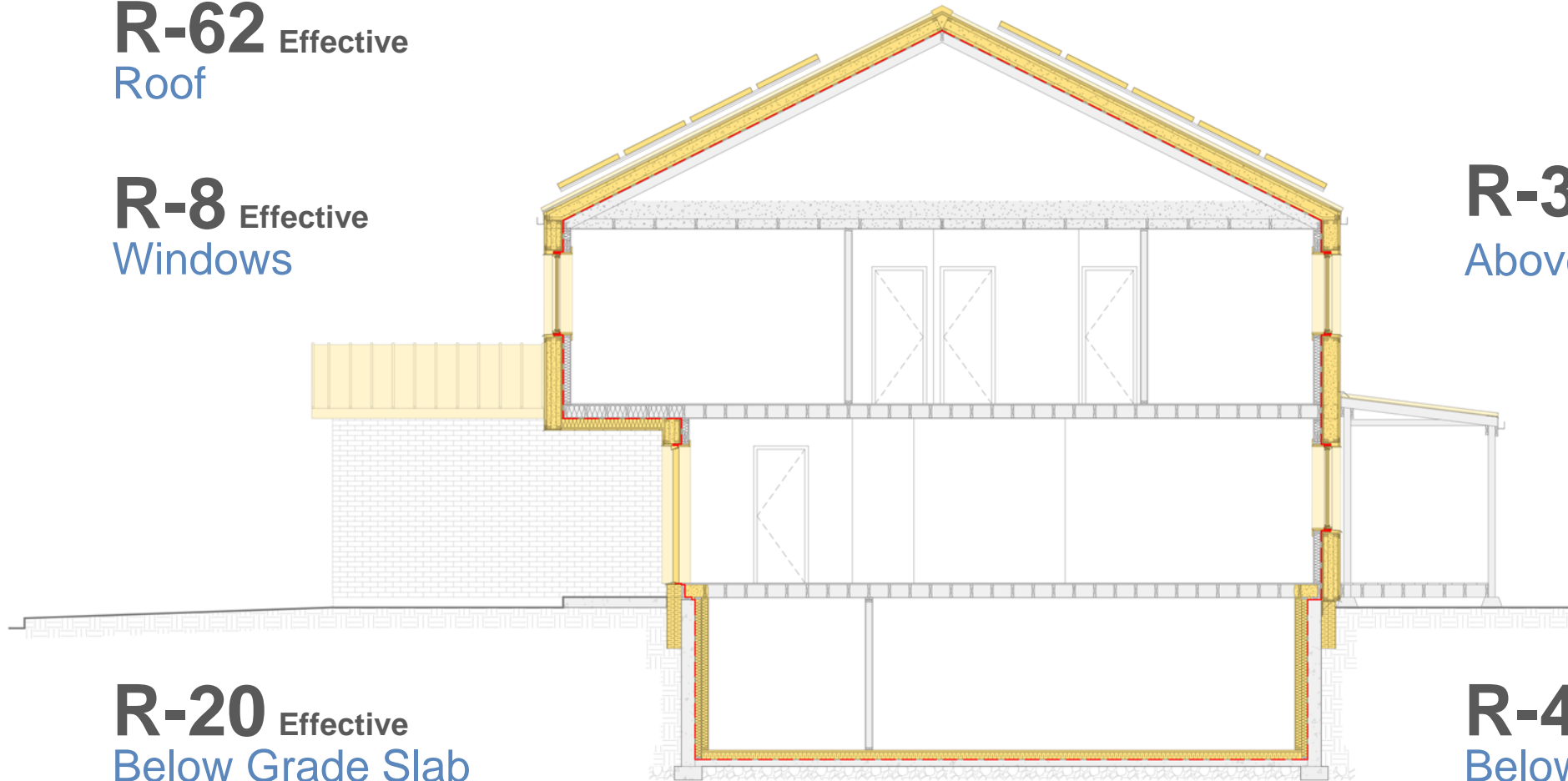
**R-62** Effective  
Roof

**R-8** Effective  
Windows

**R-38** Effective  
Above Grade Walls

**R-20** Effective  
Below Grade Slab

**R-42** Effective  
Below Grade Walls



North

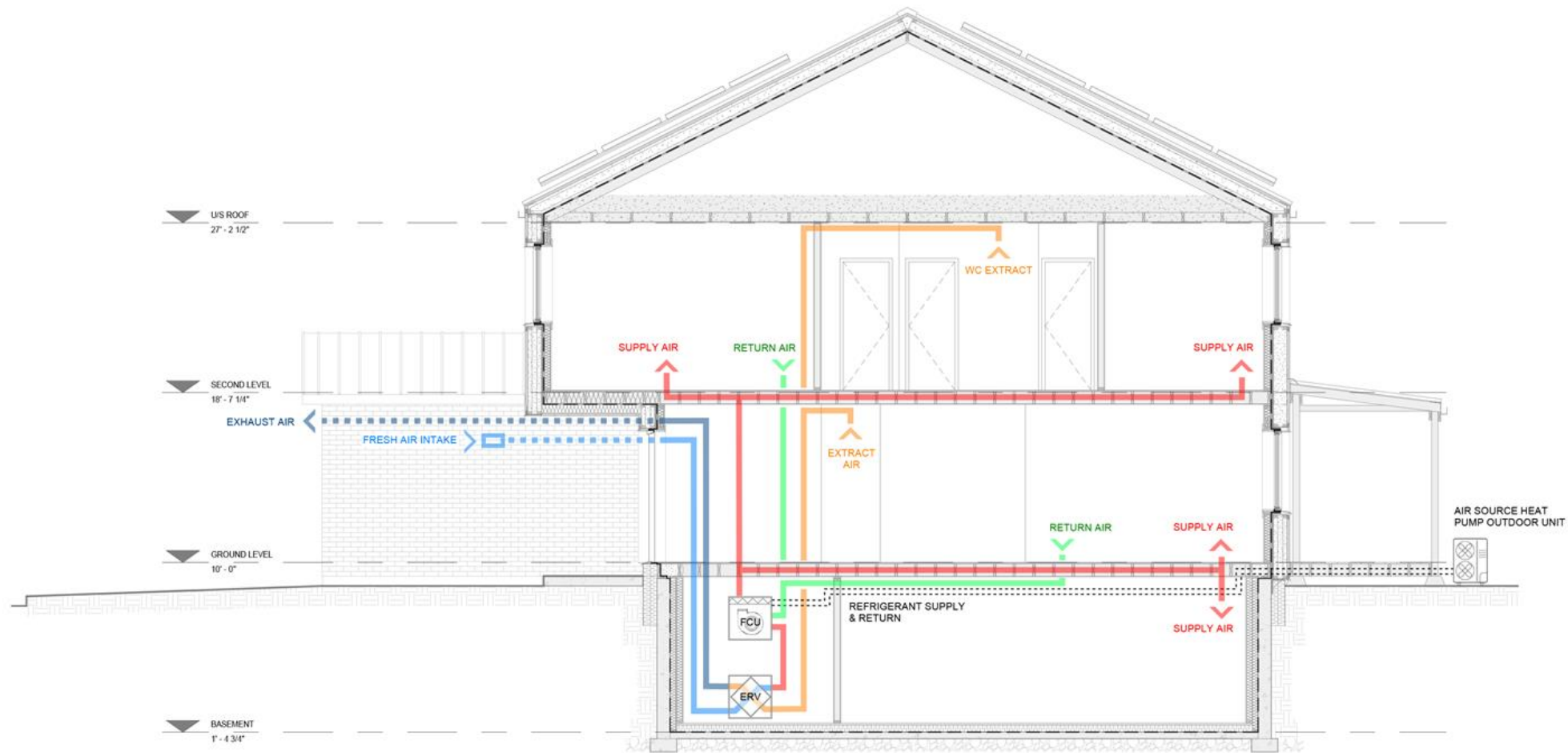


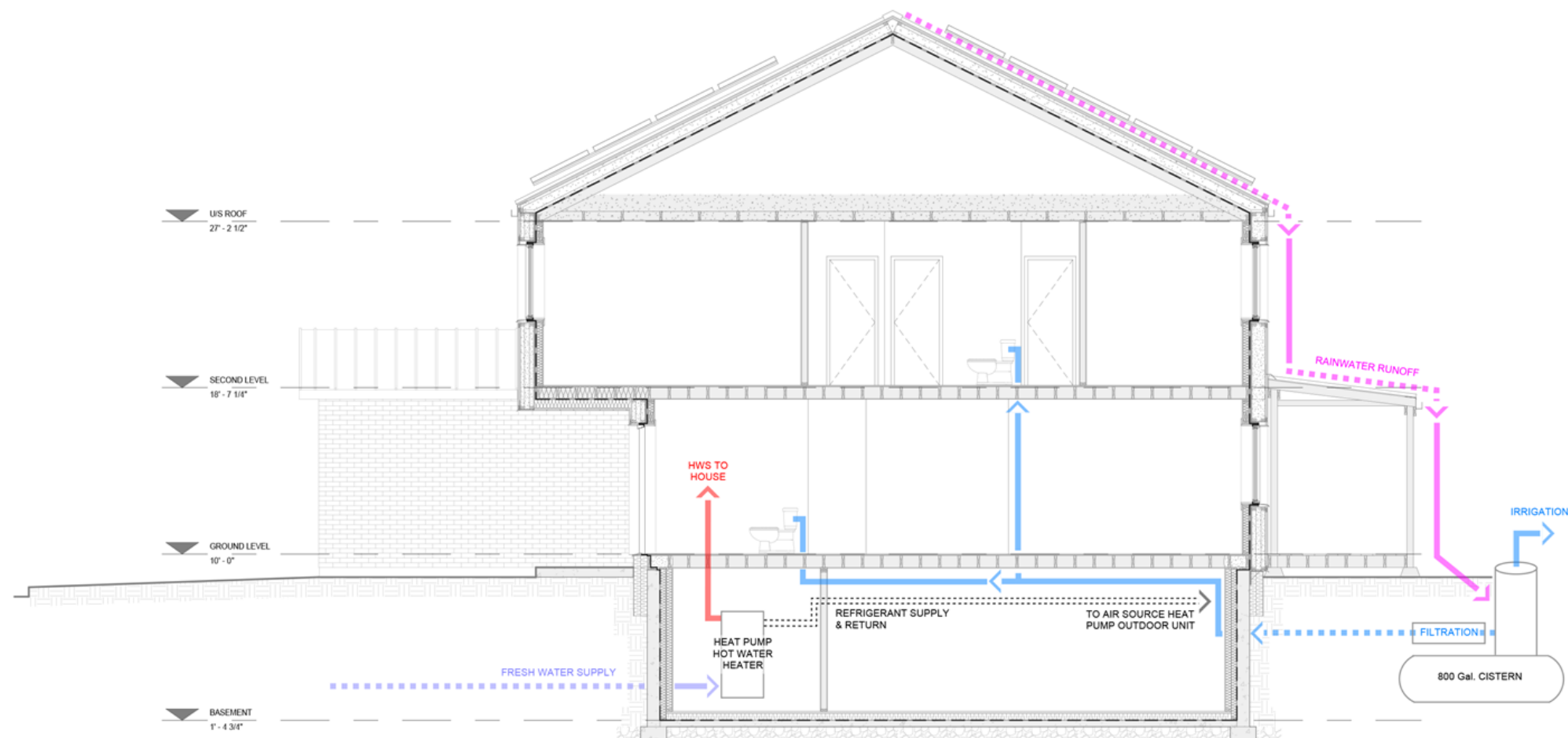
West

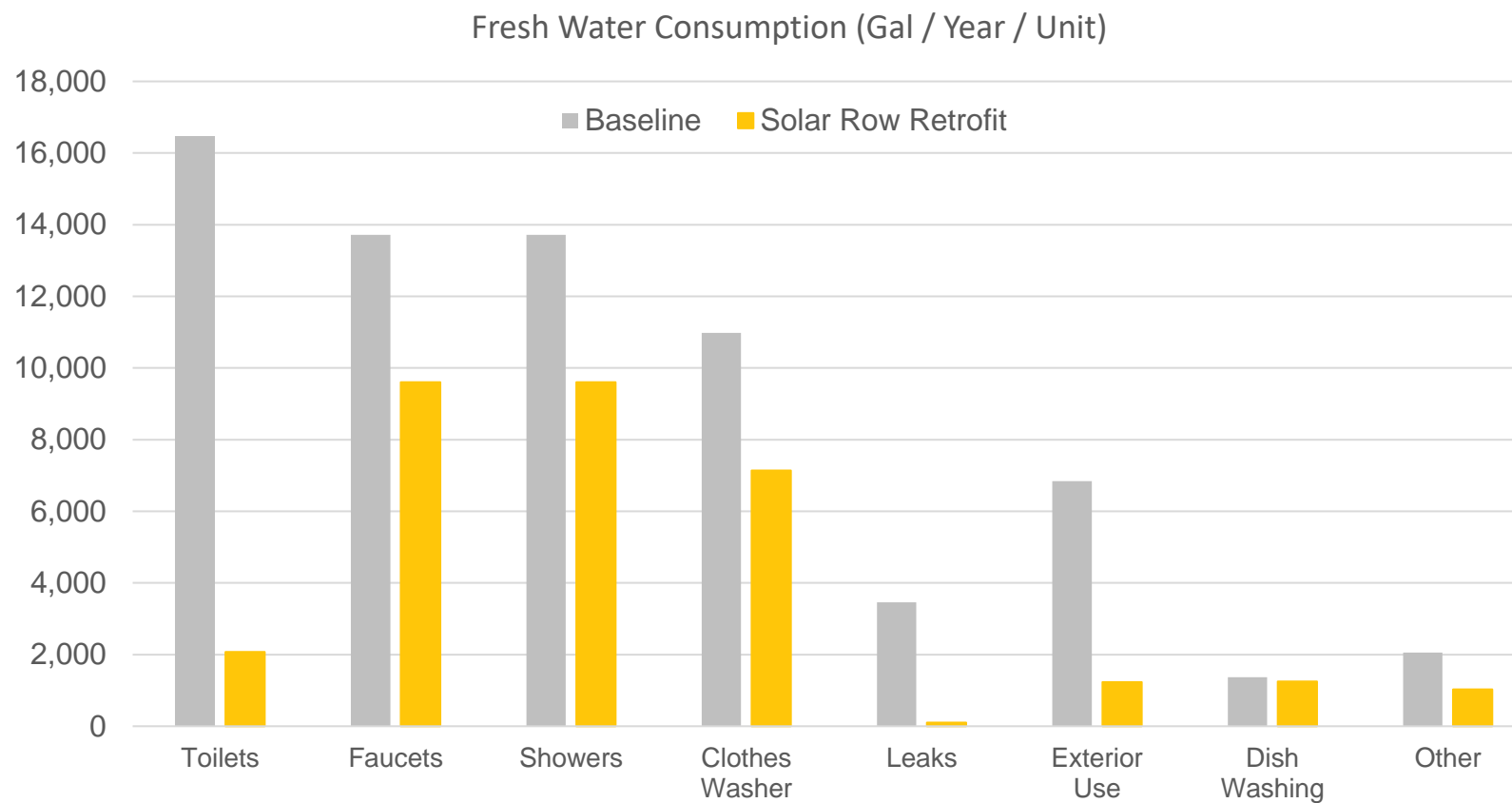


East









**54%**  
Reduction in Fresh Water Consumption





Typical Retrofit

**\$156 / ft<sup>2</sup>**

30 Year Operation &  
Maintenance Cost / Unit

**\$147,603**

Solar Row Retrofit

**\$51 / ft<sup>2</sup>**

Solar Row  
Retrofit Cost / Unit

**\$99,354**



30 Year Savings with Solar Row

**\$48,249**



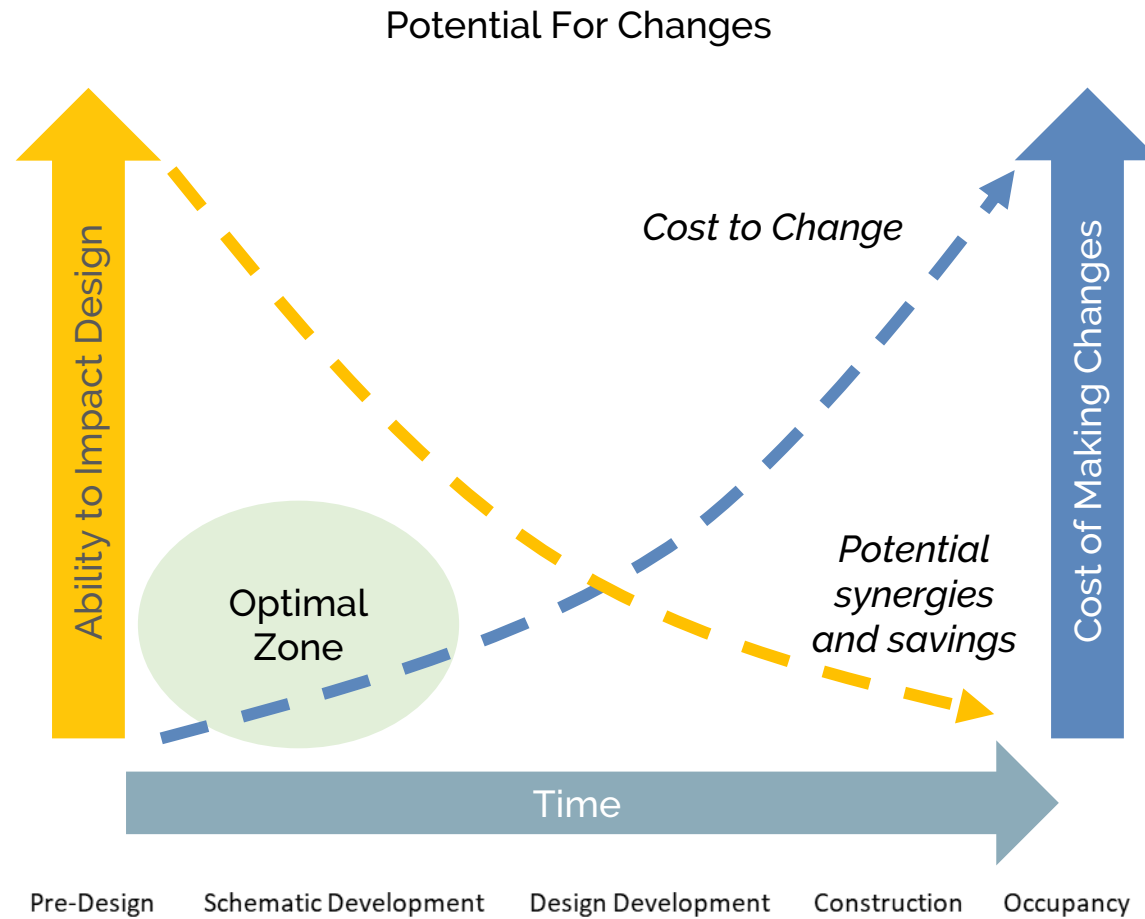
29 lbm CO<sub>2</sub>e/ft<sup>2</sup>  
Original 1975 Build



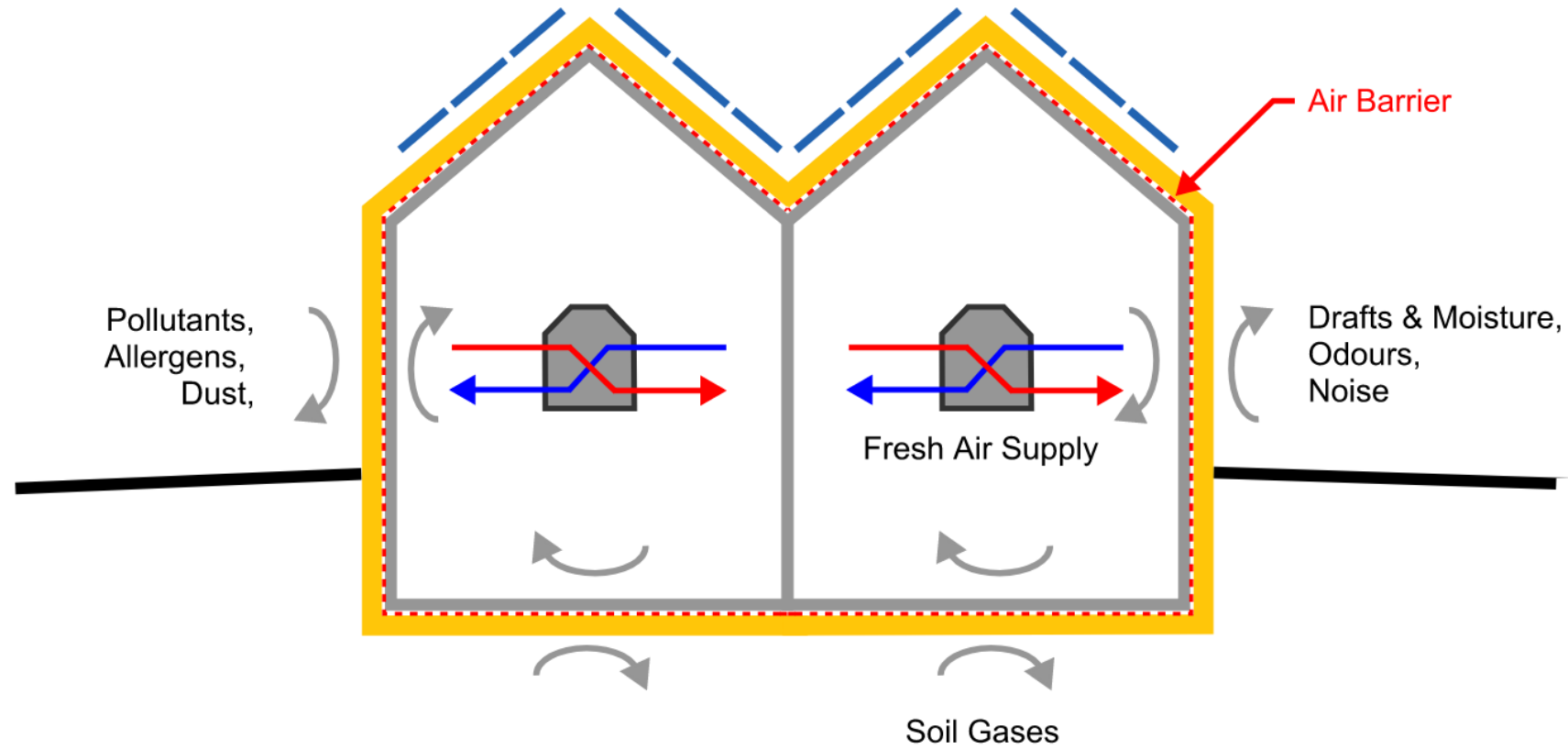
6 lbm CO<sub>2</sub>e/ft<sup>2</sup>  
Only 2022 Retrofit

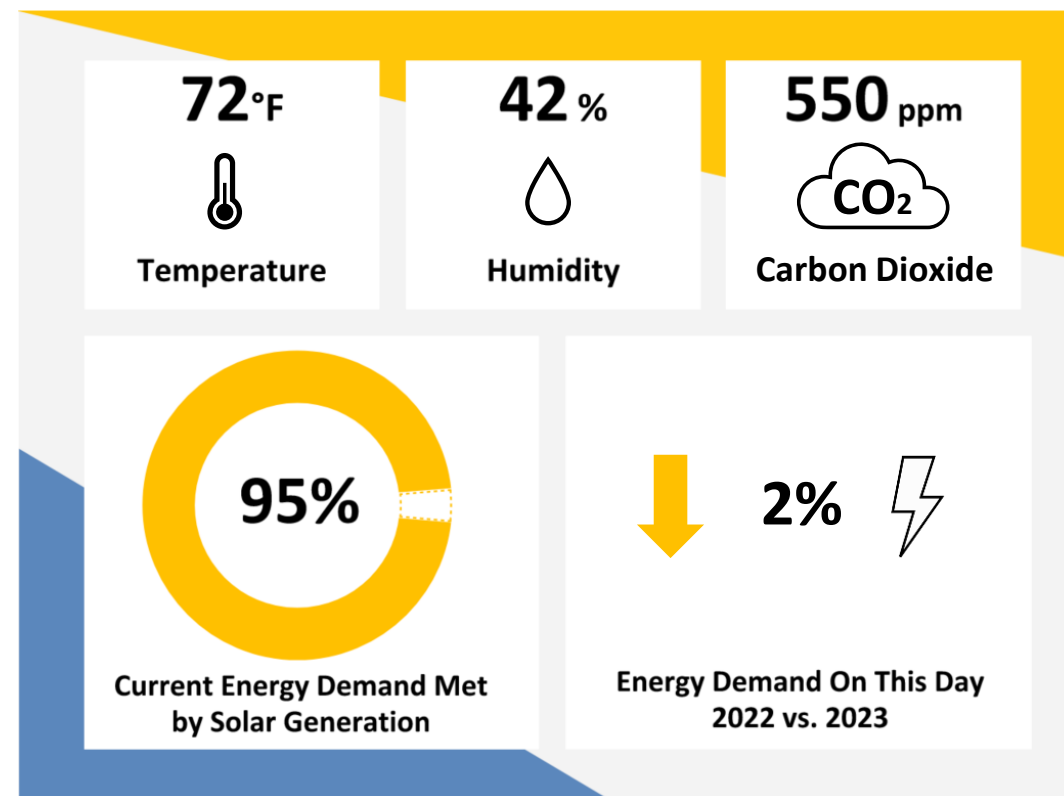


35 lbm CO<sub>2</sub>e/ft<sup>2</sup>  
Total post-retrofit embodied carbon



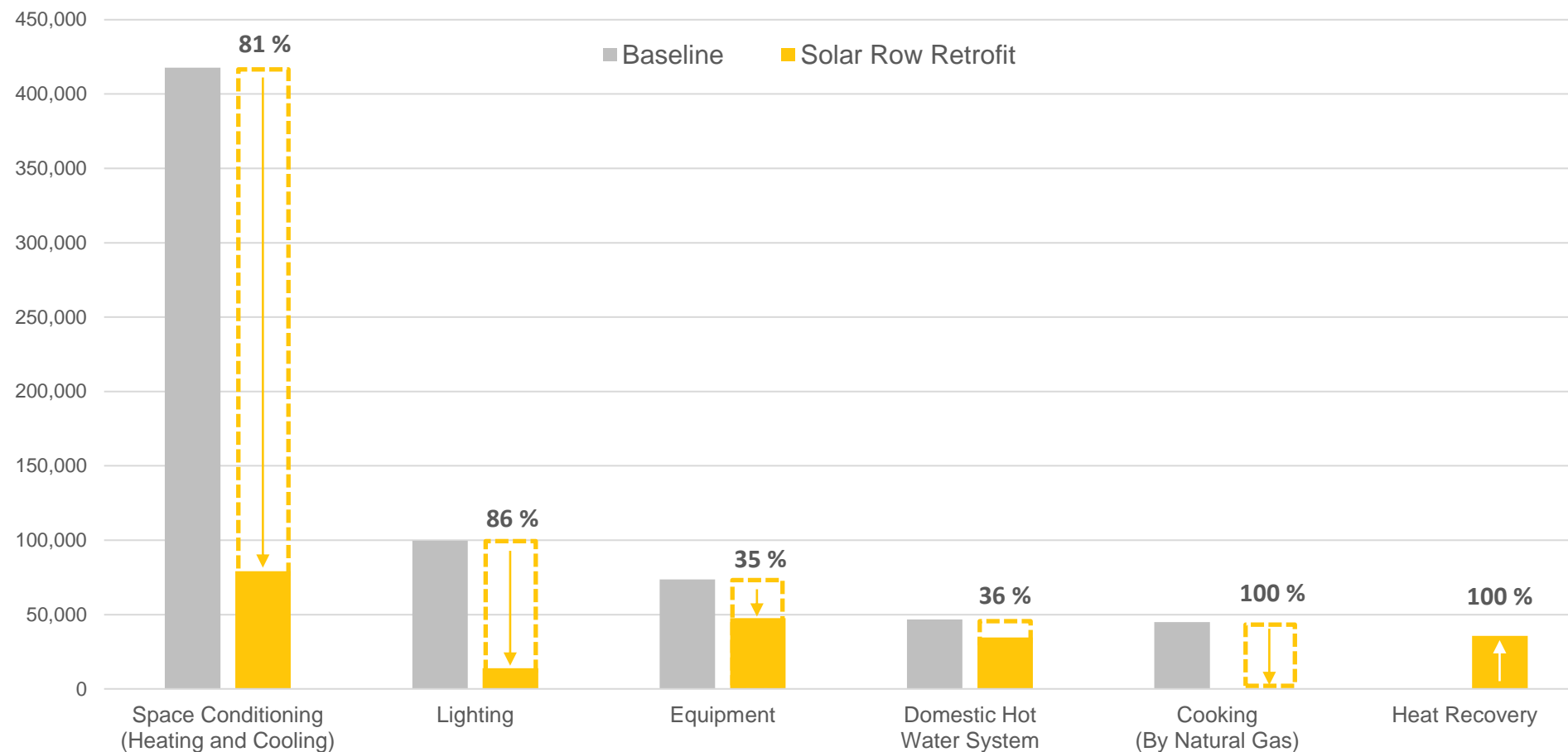


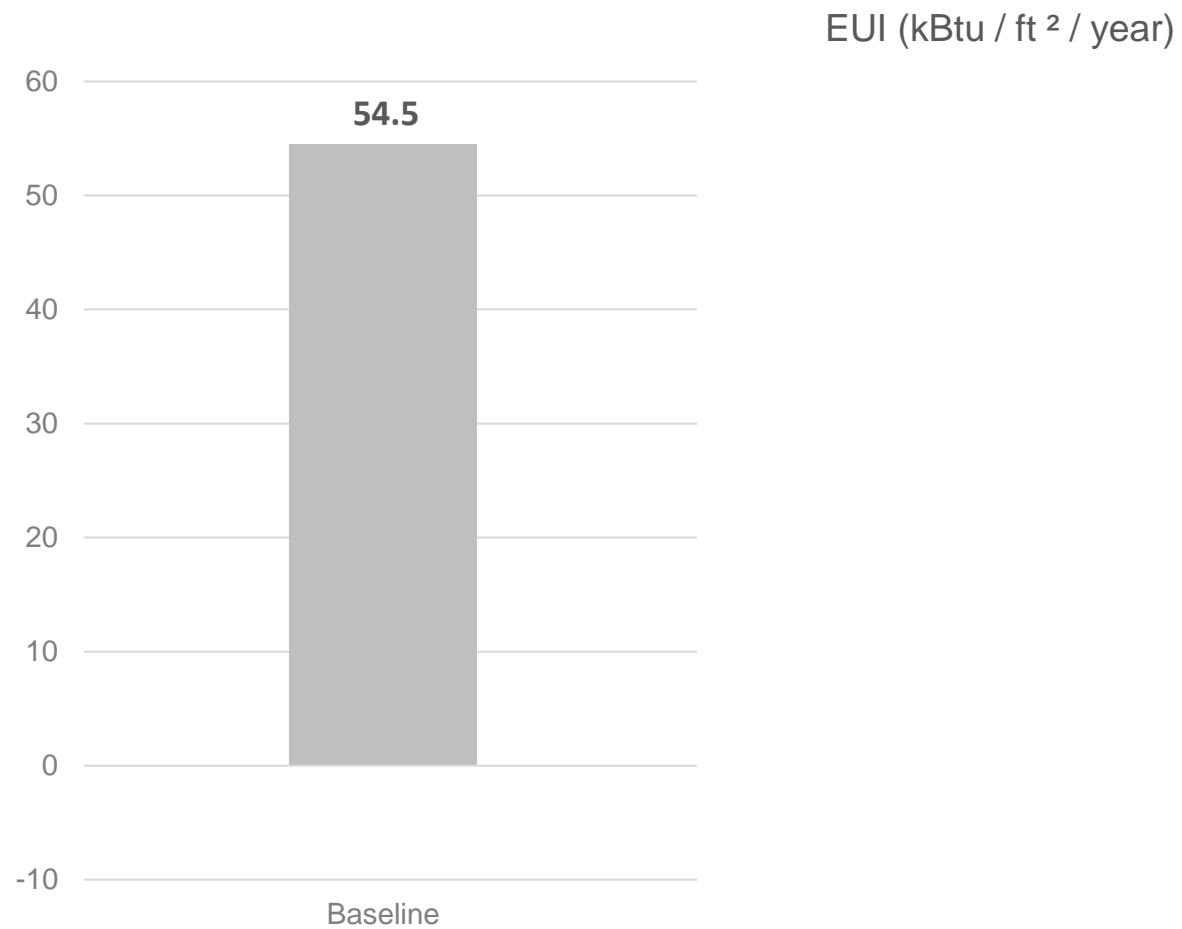
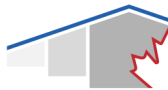


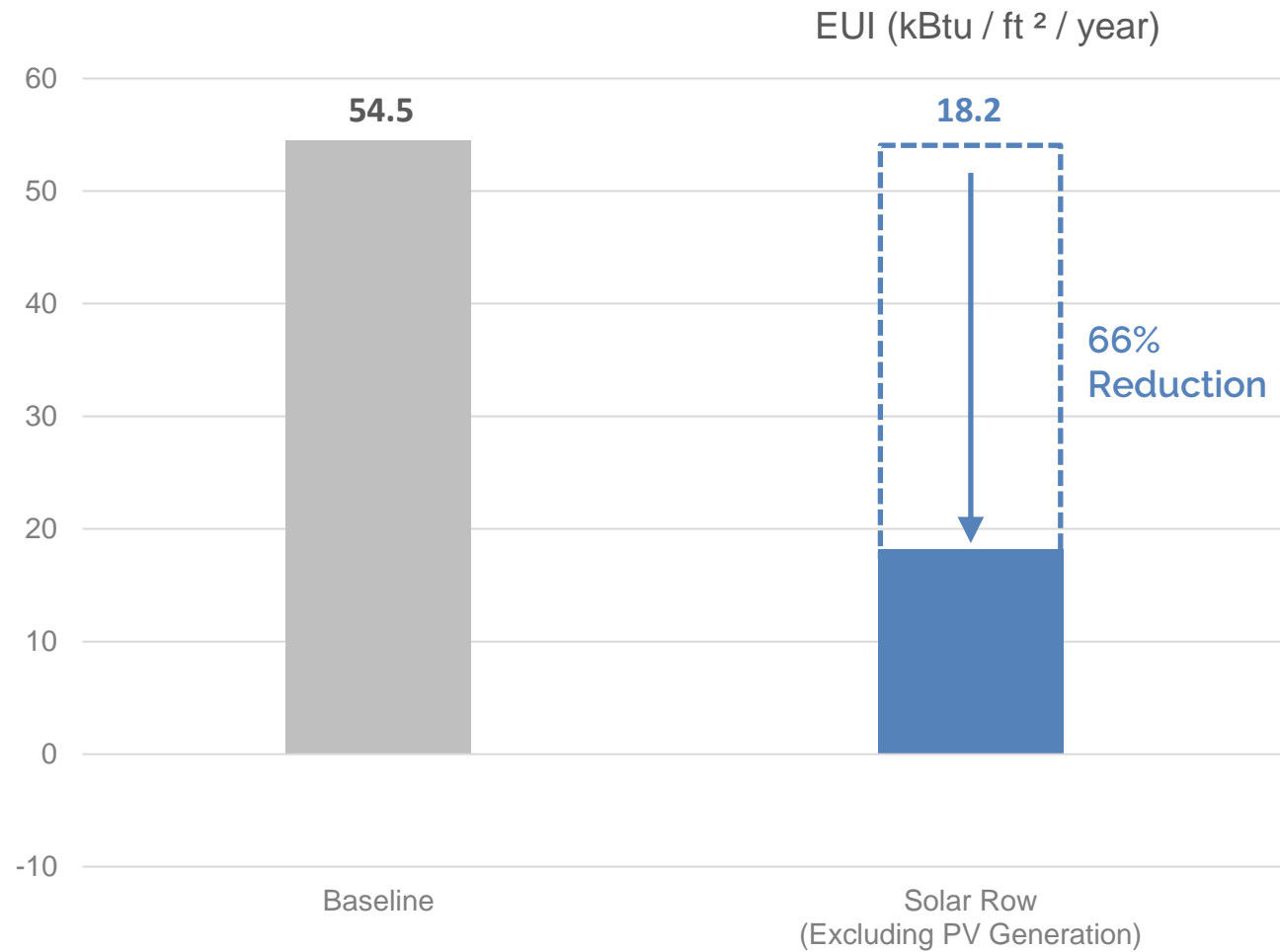


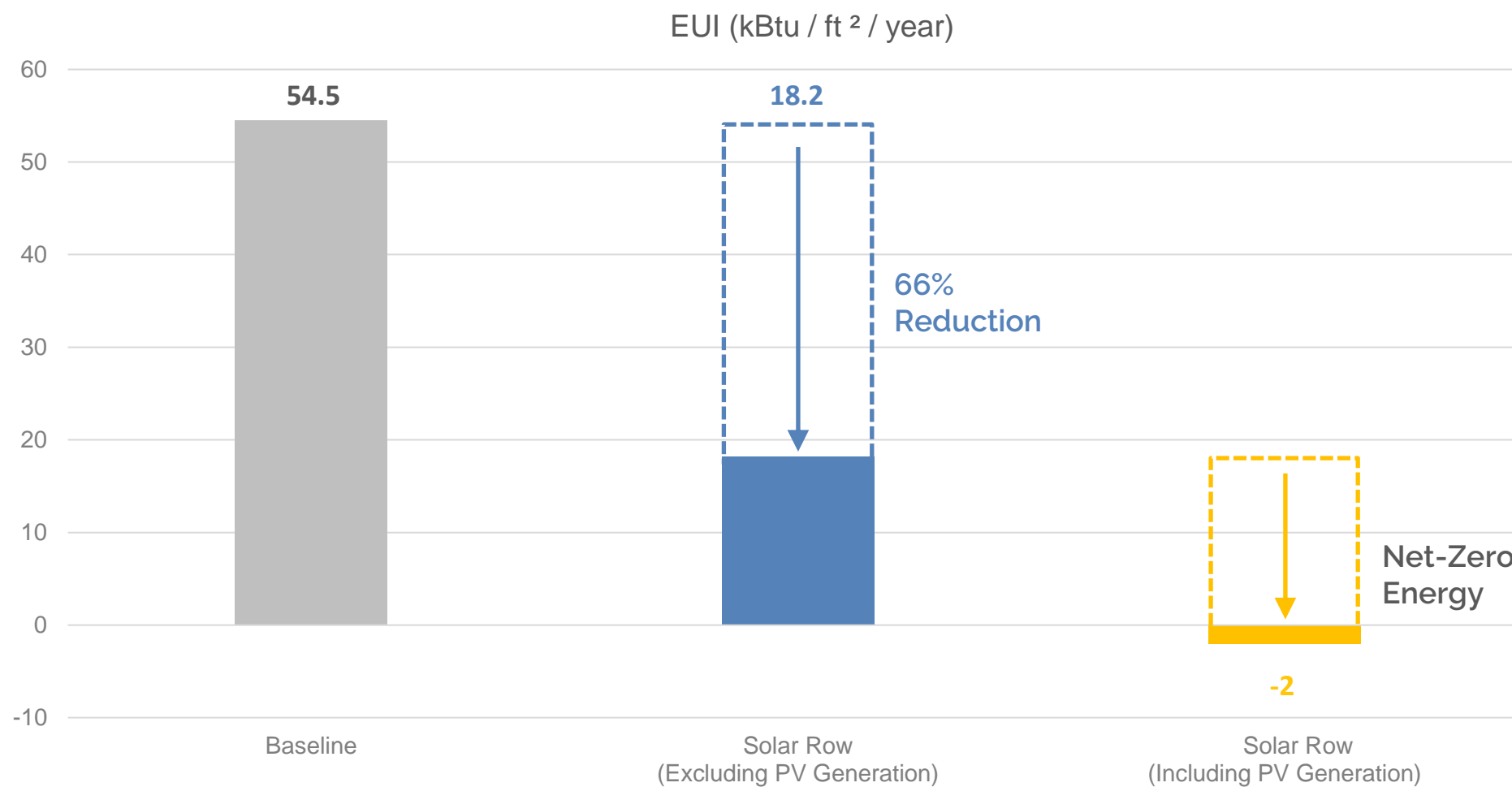


Energy Consumption by Category (kBtu / Year) for 6 Units









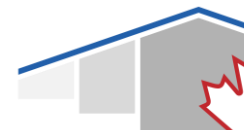
# Solar Row is

a **Scalable, Net-Zero Energy** design template  
ensuring **Occupant Wellbeing** using proven  
techniques for meaningful change





# Thank You!



**Ryerson**  
University



# References

## Slide 3:

Blog TO (2022) *This is what Toronto looked like in the 1970s*. Retrieved on 6-March 2022 from: [https://www.blogto.com/city/2010/09/toronto\\_of\\_the\\_1970s/](https://www.blogto.com/city/2010/09/toronto_of_the_1970s/)

Toronto Public Library (n.d.) *Condominium townhouses built by Bramalea Consolidated Developments*. Retrieved on 6-March 2022 from: <https://digitalarchive.tpl.ca/objects/332206/condominium-townhouses-built-by-bramalea-consolidated-develo>

Toronto Public Library (n.d.) *The Lakes, townhouse condominium project*. Retrieved on 6-March 2022 from: <https://digitalarchive.tpl.ca/objects/330869/the-lakes-townhouse-condominium-project-ajax-ontario>

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## Slide 25:

Enbridge (2018) *Integrated Design Process – Conserving Energy in New Construction*. Park Avenue Homes – IDP Workshop Summary. November 7, 2018

## Slide 26:

Enbridge (June 2021) *Savings by Design: Conserving Energy in New Construction*. Retrieved on 22-February 2022 from: [https://www.dropbox.com/s/nm9bbtrcaauqf0a/SBD\\_IEQ\\_Yorkwood%20Homes%20Caledon%20Limited\\_Attached\\_20528.pdf?dl=0](https://www.dropbox.com/s/nm9bbtrcaauqf0a/SBD_IEQ_Yorkwood%20Homes%20Caledon%20Limited_Attached_20528.pdf?dl=0)